Taurus

The Taurus software package performs intake and dose calculations for internal radiological contamination in occupational exposures. It was developed by the UK Health Security Agency's Internal Dosimetry Group, UK.

Taurus provides a simple graphical user interface (GUI) to UKHSA's internal dosimetry computer code Pleiades (Fell T.P. et al, 2007). Pleiades is written in Fortran and has been used for the calculation of reference dose coefficients and bioassay quantities published in the International Commission on Radiological Protection (ICRP) Occupational Intakes of Radionuclides series of publications (ICRP 2016b, 2017, 2019). Taurus thus implements the most recent ICRP recommendations (ICRP 2007) and the accompanying biokinetic, dosimetric models (ICRP 2009, 2015, 2016a, 2016b, 2017, 2019, 2022) and radiological decay data (ICRP 2008).

In addition to calculating radionuclide activity in organs and excreta and committed doses due to occupational exposures, Taurus also estimates radionuclide intakes from bioassay data using the well proven maximum-likelihood fitting module previously used in UKHSA's IMBA software (Birchall et al,2003) which can produce robust estimates of multiple intakes using several types of bioassay data, including censored observations (e.g. less than the limit of detection results). IMBA is the predecessor of Taurus and only implements previous ICRP recommendations (ICRP 1994).

Plotting of measurements and bioassay predictions is through Dynamic Data Exchange with Dplot Graph software for scientists and engineers, by Hydesoft computing LLC, a freely distributable restricted functionality version of which (DPlot Jr) is included in the Taurus installation package. If a full version of DPlot is installed Taurus will benefit from the increased functionality which this provides.

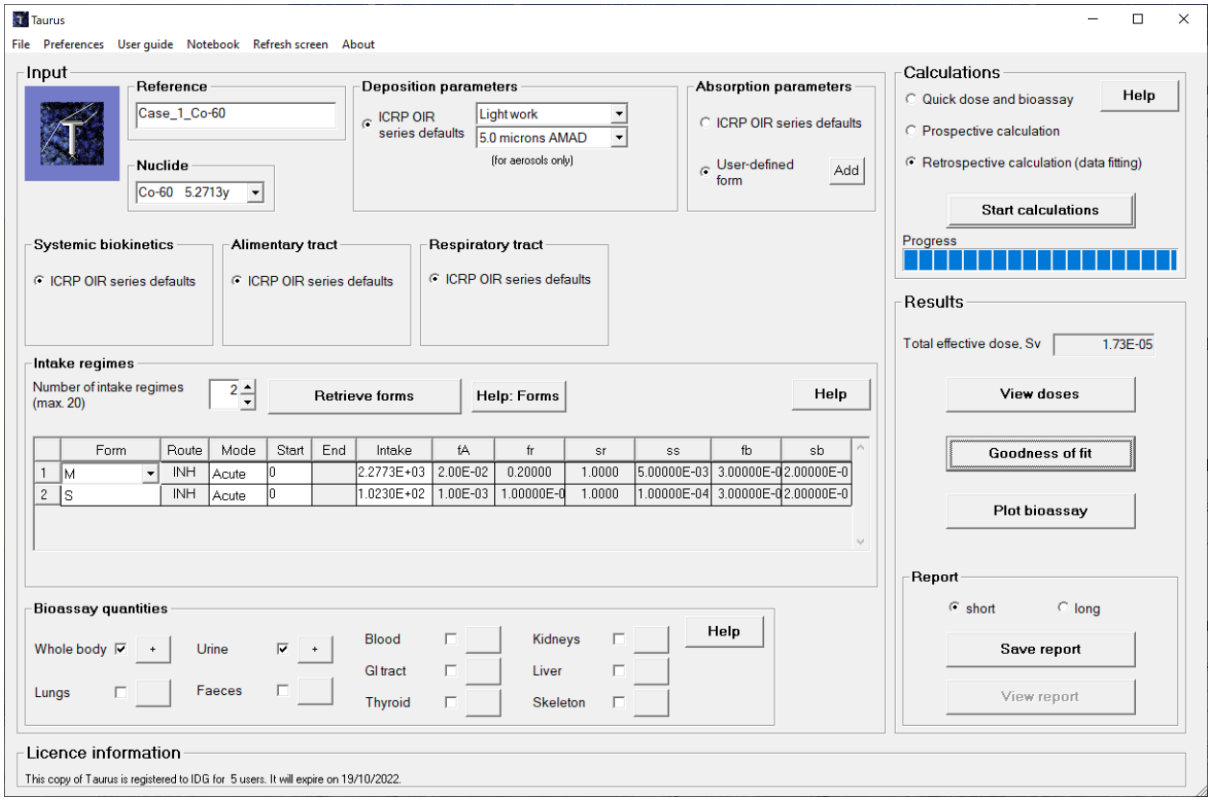
The Taurus GUI was built using the Winteracter Portable Fortran user interface and graphics toolset by Interactive Software Services Ltd.

Taurus enables the user to:

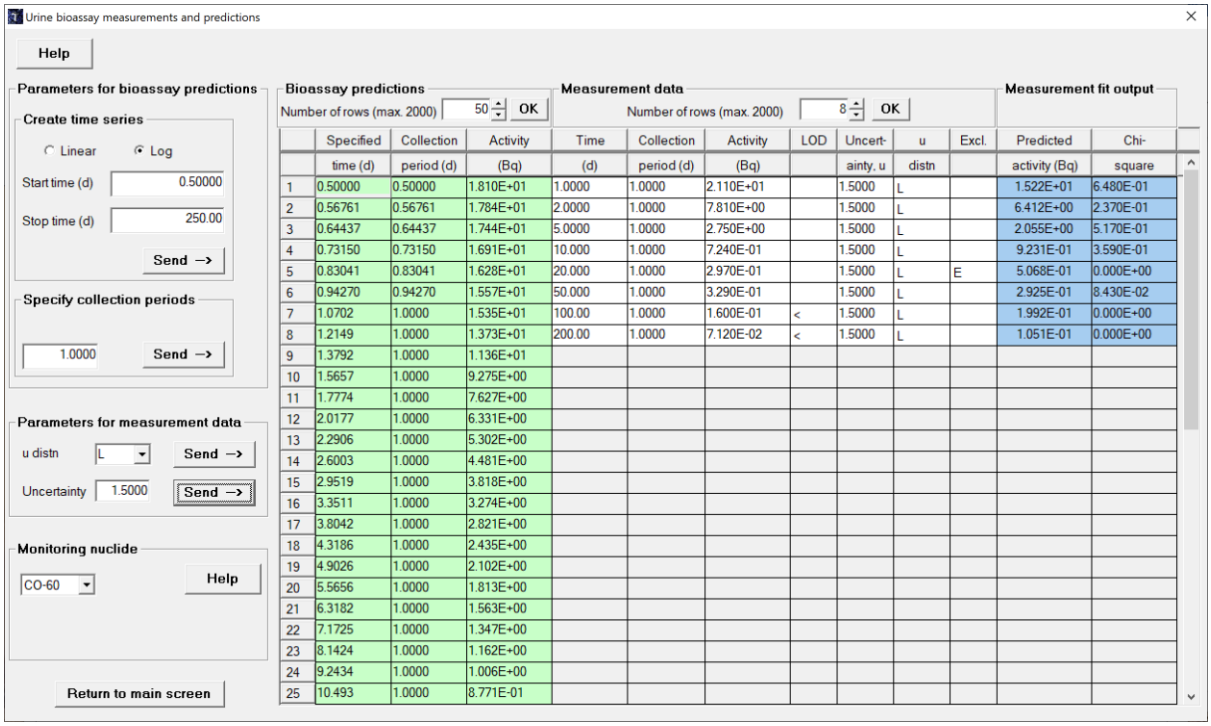
- calculate equivalent organ doses and effective doses and bioassay quantities from one or more specified intakes and at pre-defined time-points
- calculate doses and bioassay quantities from one or more specified intakes and at user-specified time points
- estimate single or multiple intakes from measurements of activity in the body and/or excreta and to calculate the resulting doses.

Activity and doses are given in S.I. units of bequerel (Bq) and sievert (Sv).

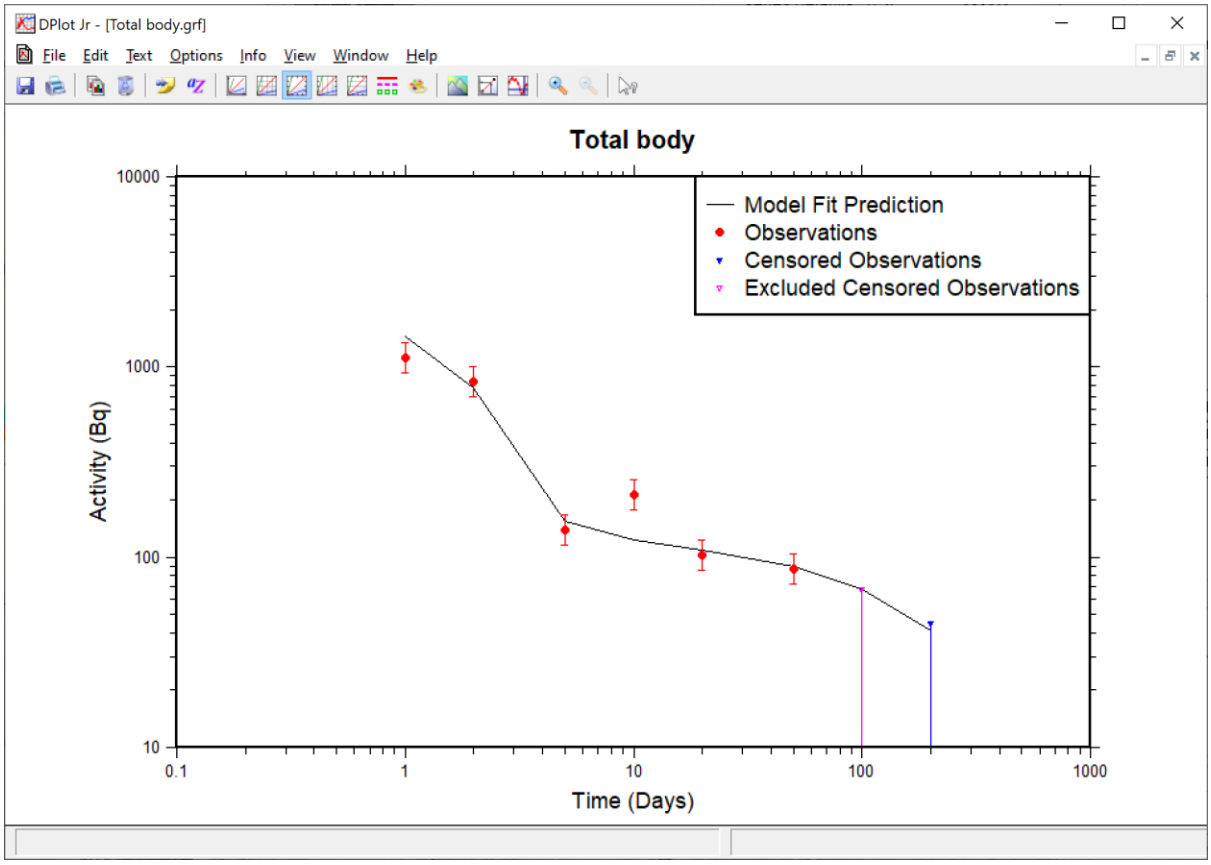
Main screen

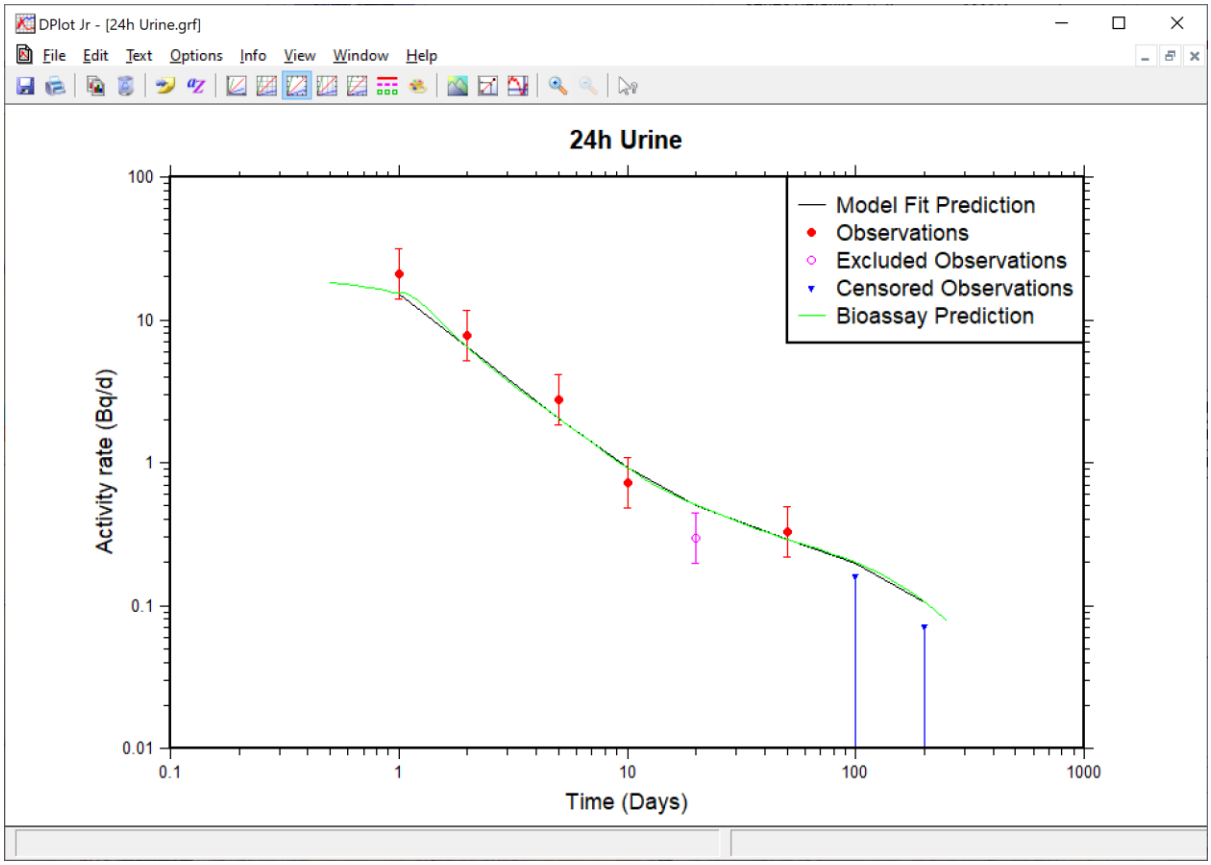


Bioassay screens



Plot of bioassay data





Tables for effective and equivalent doses (total and for each intake regime)

Equivalent doses, Sv

IR 11 | IR 12 | IR 13 | IR 14 | IR 15 | IR 16 | IR 17 | IR 18 | IR 19 | IR 20

Total | IR 1 | IR 2 | IR 3 | IR 4 | IR 5 | IR 6 | IR 7 | IR 8 | IR 9 | IR 10

Intake (Bq, acute) 2.2773E+03

Effective dose coefficient (Sv/Bq): 6.2E-09

Effective dose (Sv) 1.41E-05

	Male	Female
R-marrow	8.21E-06	1.07E-05
Colon	8.71E-06	9.20E-06
Lungs	4.30E-05	4.95E-05
St-stem	1.06E-05	1.00E-05
Breast	8.39E-06	1.10E-05
Ovaries	0.00E+00	5.31E-06
Testes	1.55E-06	0.00E+00
UB-wall	3.33E-06	4.34E-06
Oesophagus	1.54E-05	1.95E-05
Liver	1.53E-05	1.71E-05
Thyroid	9.35E-06	1.06E-05
Endost-BS	5.51E-06	7.25E-06
Brain	2.78E-06	3.59E-06

OK

Information on goodness-of-fit

Statistical tests

Chi-square | Autocorrelation

Help

Goodness-of-fit statistics

Total ChiSquare 1.338E+01

Probability 1.460E-01

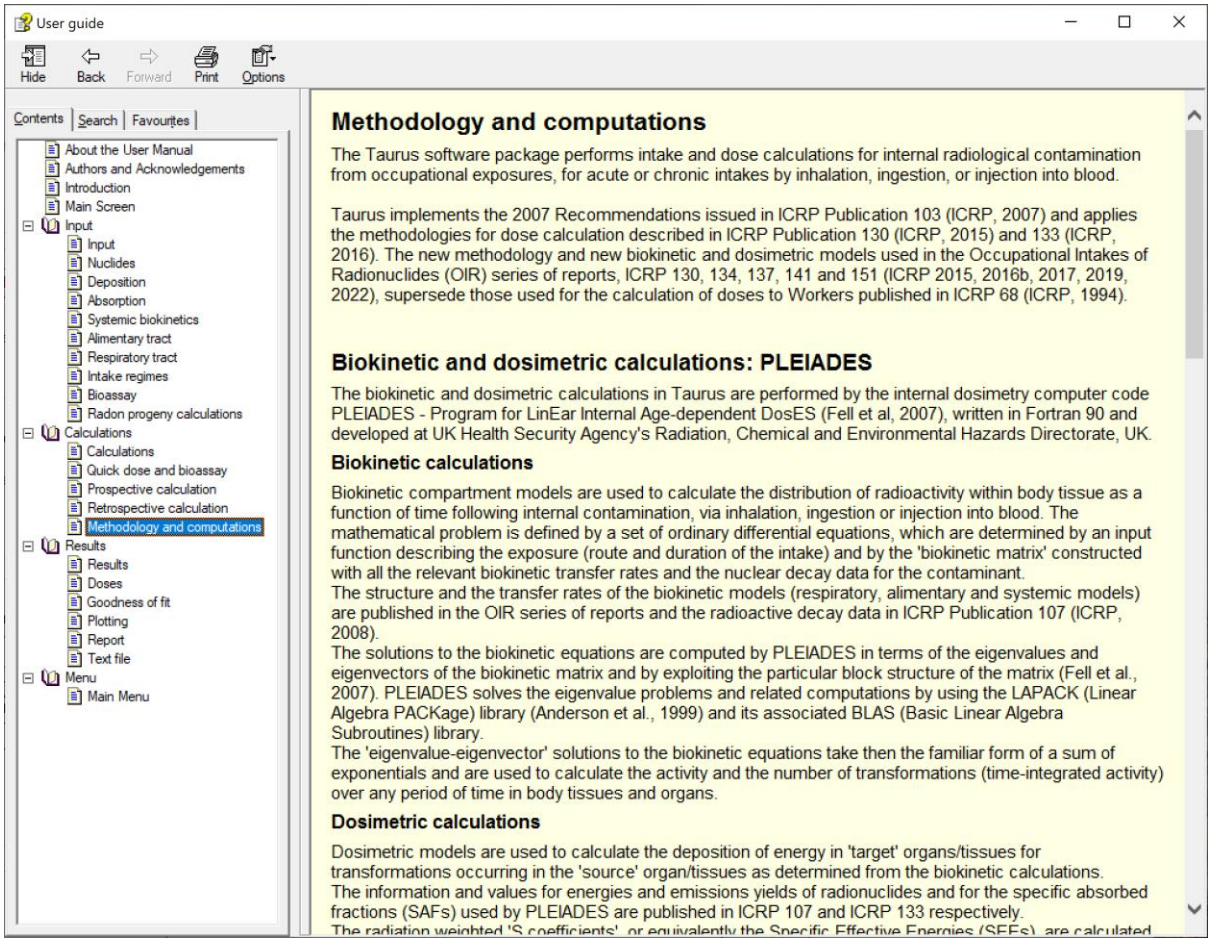
Degrees of freedom 9

Diagnostic information

Bioassay	N	ChiSquare	Probability
Total body	6	1.154E+01	3.939E-02
24h Urine	5	1.845E+00	7.759E-01

OK

Comprehensive User Guide



References

Birchall, A., Puncher, M., James, A. C., Marsh, J. W., Jarvis, N. S., Peace, M. S., Davis K. and King, D. J. (2003). IMBA Expert: internal dosimetry made simple. Radiation Protection Dosimetry, 105(1-4), 421-425.

Fell, T. P., Phipps, A. W. and Smith, T. J. (2007). The internal dosimetry code PLEIADES. Radiation Protection Dosimetry, 124(4), 327-338.

ICRP, 1994. Dose Coefficients for Intakes of Radionuclides by Workers. ICRP Publication 68. Ann. ICRP 24 (4).

ICRP, 2007. 2007 Recommendations of the International Commission on Radiological Protection (Users Edition). ICRP Publication 103 (Users Edition). Ann. ICRP 37 (2-4).

ICRP, 2008. Nuclear Decay Data for Dosimetric Calculations. ICRP Publication 107. Ann. ICRP 38 (3).

ICRP, 2009. Adult Reference Computational Phantoms. ICRP Publication 110. Ann. ICRP 39 (2).

ICRP, 2015. Occupational Intakes of Radionuclides: Part 1. ICRP Publication 130. Ann. ICRP 44(2).

ICRP, 2016a. The ICRP computational framework for internal dose assessment for reference adults: specific absorbed fractions. ICRP Publication 133. Ann. ICRP 45(2), 1-74.

ICRP, 2016b. Occupational Intakes of Radionuclides: Part 2. ICRP Publication 134. Ann. ICRP 45(3/4), 1-352.

ICRP, 2017. Occupational Intakes of Radionuclides: Part 3. ICRP Publication 137. Ann. ICRP 46(3/4).

ICRP, 2019. Occupational Intakes of Radionuclides: Part 4. ICRP Publication 141. Ann. ICRP 48(2/3).

ICRP, 2022. Occupational Intakes of Radionuclides: Part 5. ICRP Publication 151. Ann. ICRP 51(1-2).